Defense Waste Processing Facility

Tour Script

Lobby 704-S

Entrance

This is the Defense Waste Processing Facility (or DWPF) – a Vitrification plant operated to treat High Level liquid radioactive waste. The plant receives liquid waste feed material from the H-Tank Farm via underground transfer lines. The feed material is pre-treated and fed into a Joule-heated Melter where it is heated into a molten glass and poured into stainless steel canisters. The material solidifies inside the canister into a glass form that encapsulates the waste.

We will watch an overview film that lasts ~3 minutes which briefly describes the DWPF process.

Watch Film

We will split into five groups for the walking tour. When we get into the building, it is noisy in places, and access to some of the viewing windows is limited. We will cycle people through at the viewing windows, and repeat the information if necessary such that everyone can see and hear. It is important to use the handrails when climbing steps in the

Vitrification Building for personnel safety reasons. You may see signs requiring flashlights in the Vitrification Building. Your tour guide will have one, which will adequately address this need for you.

Cut-Away Canister

This is a cut away view of a non-radioactive canister that was processed during startup testing. The glass material looks the same as the radioactive waste product. Note that long term credit is taken for encapsulating waste in the glass form, not the canister. The dose rates for cans presently being produced, which are sludge waste only, are ~ 5 Rem/hour on contact. In the future, when the facility begins to produce cans that contain salt waste; the contact dose rate will increase to ~ 5000 Rem/hour.

Empty Canister

This is an actual canister. It is made of stainless steel and is 10 feet tall, 2 feet in diameter, 3/8 inch thick and weighs ~ 1100 pounds empty. Canisters are manufactured offsite by a sub-contractor.

Point out diagram "Vitrification Building 221-S"

This is a diagram of the 3-story Vitrification Building. The remote processing area is in the interior. Due to the high radiation rates and high contamination levels, this area is mostly inaccessible. Some of the cells have provisions for personnel entry for decontamination operations and hands on maintenance on the Welder. The yellow area represents the operating space accessible to personnel.

Point out diagram "Glass Waste Storage Building"

This is a cross-sectional view of Glass Waste Storage Building #1. There is a second Glass Waste Storage Building, recently completed and placed into service in 2006, whose design is very similar to #1. The storage vault is underground, with a storage rack for each canister. The vault is cooled by natural circulation flow from east to west and discharging up the stack. The vault ventilation fans are not currently used, as more detailed analysis determined that natural circulation would provide adequate cooling. For this same reason, Glass Waste Storage Building # 2 design does not include vault ventilation fans. The operating floor is at ground level. A Shielded Canister Transporter moves canisters from the Vitrification Building to the Glass Waste Storage Buildings. It removes the shield plug, lowers the canister into the vault and replaces the plug. Glass Waste Storage Building #1 contains 2286 storage locations and is near full, whereas Glass Waste Storage Building #2 has 2340 storage locations, and has < 50 canisters

stored in it. A third storage building will be needed in ~ 9-10 years at present production rates.

Canister Closure Demo

When a canister has been poured, a tapered plug is inserted into its neck to provide closure during the decontamination process. The hot can cools and shrinks around the plug to provide an airtight seal. After decontamination the tapered plug and sleeve are pressed into the can, and a weld plug is placed over the canister opening. The welder then presses the weld plug into place as the weld current is applied to seal the can.

Hanford Connector

All piping and electrical connections inside the remote process cells are joined via jumpers which can be remotely moved using a crane. The end connectors are Hanford connectors which can be loosened or tightened by an impact wrench slung from the Main Process Crane. The jumpers have a loop that is engaged by a hook on the crane and are each balanced to maintain orientation during raising or lowering.

Melter Diagram

This is a diagram of the Melter. It is ~ 8 feet tall and ~ 8 feet in diameter. The shell is stainless steel with ~ 1 foot of brick insulation around the inside. The waste/frit feed mixture is melted by 2 sets of electrodes. The vapor space is heated by dome heaters. There are 2 feed tubes, feeding from the top at ~ ½ gallon per minute. The Melter operates at ~ 1100 degrees Centigrade. Air pressure is used to control the pour, with a

vacuum drawn in the pour spout to draw the molten glass up the pour spout during pouring. Canisters are staged on a 4 position turntable under the pour spout. A drain valve on the bottom allows draining into 5 pre-staged canisters on a turntable before Melter replacement. The Melter has a design life of 2 - 5 years; however our performance to date has been better than this. The first Melter lasted for ~ 8 ½ years, and the current Melter has been in operation for 4 years. Since this is the critical component with a significant lead time, a spare Melter must be available and is currently in 717-F.

Walk 704-S to 210-S

The 2 large buildings off to the right are the Glass Waste Storage Buildings. Building #2 to the north was completed and placed into service in 2006. Note that building #1 has 4 ventilation fans and stacks, whereas building #2 has a large chimney. As mentioned earlier, the fans are no longer in use. The trailers to the right house the engineering staff. The large buildings off to the left house work control, purchasing, other support staff and include warehouse space. The tall concrete structure is the Vitrification Building which houses the main processing equipment.

<u>210-S</u>

Entry – This is 210-S which houses the Control Room, Maintenance shops, operating areas for support equipment and office space for Operations and Maintenance management. The facility is currently in a maintenance outage, so manning and activity levels are not necessarily what you might see during normal operations.

Supervisory Control Room

This is the Supervisory Control Room which serves as office space for the Shift Manager and as the Command and Control point during upset conditions or emergencies. The facility is staffed by four operating shifts, working 12 hour shifts on a rotating basis. The shifts consist of operators, radiological control technicians, maintenance workers and supervisors for each group. The facility operates 24 hours/day, 7 days a week, and produces about 6 cans per week.

Vitrification Control Room

This is the Vitrification Control Room. The facility has a combination of remotely and locally controlled and operated processes. The Vitrification Control Room provides controlling stations for operators and a supervisor who operate the remotely controlled

and automated processes. The process is operated using a Distributed Control System, with each operator and supervisor having an individual station. Four operating stations and one supervisory station are provided.

Crane Control Room

This is the Crane Control Room. The facility has a Main Process Crane which can remove cell covers, move equipment between cells and remove equipment for maintenance. The Crane Control Room is the controlling station for the Main Process Crane. It is operated by a joystick using 8 cameras mounted on the crane. The crane is capable of lifting any equipment in the canyon (including pumps, jumpers, and individual tanks including the Melter.)

Canister Receipt Area

This is the Canister Receipt Area. The Canister Receipt Area is used for receipt and storage of new canisters, each in their own storage rack. A shipment of 36 canisters is received ~ every 2 months from the off site manufacturer. The canisters are moved using a modified fork lift device (point out). Canisters are moved into the Vitrification Building using a grapple on an overhead rail. They enter through these (point out) double doors and will come out through another set of similar doors inside.

221-S Vitrification Building

Entry – We will pass through an airlock and into the Vitrification Building. We will be entering a Radiological Buffer Area where no contamination is expected to be found. No eating, drinking, chewing, etc. is allowed. While it is unlikely that any contamination is present, the RBA is established to provide a "buffer" between the contaminated area of the remote processing section and the "clean" portions of the facility. Therefore, we will be monitored by Radiological Control Technicians prior to exiting across the yellow and magenta taped barrier.

Entry of 221-S

These are the double doors where the canisters enter the building (point out).

Contact Decontamination Maintenance Cell

The stainless steel lined Contact Decontamination Maintenance Cell is used for hands on maintenance on contaminated equipment. Typical work includes rebuilding pumps, re-gasketing jumpers, welding on various equipment, cutting up old jumpers, etc. Work in the Contact Decontamination Maintenance Cell is normally performed in plastic air fed suits.

Remote Equipment Decontamination Cell

The stainless steel lined Remote Equipment Decontamination Cell is used for remote decontamination of process equipment prior to performing hands on work in the Contact Decontamination Maintenance Cell. Steam, nitric acid and CO2 pellets are used as

decontamination media. Remotely operated Electro Mechanical Manipulators are installed to position equipment used in decontamination operations. This cell is inaccessible to personnel.

Melt Cell – Window MC-5

This is the Melter (point out). Note that all the connections can be remotely disconnected. Upon replacement, the entire apparatus and associated frame work come out. Note the lifting points engaged to remove the Melter and frame. The drain valve (point out) is used to drain remaining waste from the Melter just before replacement into the five canisters pre-staged on a turntable. The Melt cell is inaccessible to personnel.

Melt Cell – Window MC-1

This is the Melter Riser (point out) and Pour Spout (point out). A bellows (point out) provides a tight seal between the pour spout and canister to prevent air in-leakage so that the air pressure system that controls pouring operations can function, and also to confine the pour stream. The Pour Turntable provides four canister storage locations. Remote manipulators are used for placing the tapered plug into the canister upon completion of filling. The Tele-Robotic Manipulator can house a camera and various tools for inspection and maintenance of the pour spout and other Melt Cell equipment.

Melt Cell – Window MC-3

The filled and plugged canister is leak tested in this position. A small volume bell jar is placed over the canister flange and pressurized with Helium (to determine that the plug is not leaking) for a drop test. The tapered plug is verified to be leak tight before being moved into a decontamination chamber. Where, it will be blasted with a frit and water mixture. The purpose of the tapered plug is to prevent entry of water into the filled canister during decontamination.

Melt Cell – Window MC-4

Note the double door which is the entry point for the canister into the Vitrification Building. The grappled canister moves on the overhead rail. The hatch is raised, and the canister is lowered onto a trolley which moves between the insertion position and the melt cell. The closest hatch plug is lifted by the in cell crane, and the canister is moved into the Melt Cell. The distant plug is lifted to insert the filled canister onto another trolley which will move it into the Canister Decontamination Cell.

Canister Decontamination Cell - Window CDC-1

The canister enters the Canister Decontamination Cell via the hatch (point out). It is moved by the In-cell Crane to one of two Decontamination Chambers. The Decontamination Cell is inaccessible to personnel.

Canister Decontamination Cell - Window CDC-3

There are two identical Decontamination Chambers which are locally operated from the field at this Operating Console (point out). The Mechanical Manipulator is removed from the chamber via the in cell crane using a grapple. The canister is then placed in the chamber and the Mechanical Manipulator is replaced. The Mechanical Manipulator grapples the canister and raises/lowers and rotates the canister while it is blasted by eight nozzles. A mix of water and frit is propelled by 100 psi air to effectively sand blast the canister and remove the oxide layer and any contamination on the canister. The mixture of metal, frit and water is captured in the chamber and fed back into the feed preparation cycle, such that a separate waste stream is not generated.

Frit Drums

(Show Frit) This is what frit looks like. It is the same material added in the Slurry Mix Evaporator that mixes with waste to form glass.

Smear Test Station

The decontaminated canister is placed in the Smear Test Station to check the effectiveness of the decontamination process. The remote manipulators are used to manually swipe the canister using adhesive swipes attached to plastic rabbits. The swipes

are transferred to the counting station via an air driven tube similar to the remote station at your bank drive up window. The swipes are collected and counted in the Hood. If the canister is found to be contaminated, it is sent back to the Decontamination Cell to be blasted again. If it is clean, it is moved forward to the Weld Test Cell. The Smear Test Station is accessible to personnel.

Weld Test Cell – Window WTC-4

Note the sign regarding pacemakers at the steps to the Weld Test Cell viewing window. No welds are being performed, so there is presently no safety concern. The cleaned canister is placed on a trolley between the Press and Weld stations. First it is moved to the Press station where a hydraulic press forces the tapered plug and sleeve ~ 1 inch down into the neck of the canister. A weld plug is moved into the Weld Test Cell via the box (point out) and onto the chute. It is placed on the canister using a manipulator. Note that the radiation rates on these cans (sludge only) is ~ 5 Rem on contact. This rate will

increase significantly up to the thousands of Rem range on contact when salt processing begins. The Weld Test Cell is accessible, provided canisters are removed or stored in shielded racks, as hands on maintenance is required on the Welder. The canister is next moved via trolley to the welder.

Weld Test Cell – Window WTC-3

The welder has upper and lower electrodes (point out). The upper serves as the press, while the lower electrodes engage the canister around its neck. The welder power supply is on the next floor up and supplies 12 volts dc. The weld process lasts ~ 1 ½ seconds, with ~240,000 amperes applied, while the press exerts a downward force of ~ 75,000 pounds. The weld process was qualified during startup, such that our welds are considered acceptable if the three weld parameters are maintained within tolerances. No physical weld inspection is required to qualify the canister weld. The canister is then swiped again and moved to the Shielded Canister Load Out Bay by way of an under ground trolley.

Leave 221-S Building

Now, we will have a hand & foot monitoring by Radiological Control Technicians before leaving the Radiological Buffer Area.

Transit to Shielded Canister Transporter Load Out Bay

Note the hardened structure which surrounds the safety grade nitrogen system. The nitrogen system serves as the backup purge ventilation source for process vessels to purge flammable gases from the tanks. The enclosure is designed to protect the system against damage from tornadoes.

Shielded Canister Transporter Load Out Bay

The Shielded Canister Transporter is used to move canisters from the Vitrification Building to one of the two Glass Waste Storage Buildings. It is diesel powered, with a primary and backup diesel engine, and is operated from the cab (point out). It has two shielded chambers. Floor plugs are raised into the smaller chamber, and canisters are raised into the larger chamber. Canisters are loaded via the floor opening (point out) which connects to an underground passage & trolley from the Weld Cell.

Walking from SCT Load out Bay to GWSB

(Point out each feature)

Sand Filter – The large white structure is the Sand Filter which filters primary ventilation exhaust.

Fan House – The Fan House contains four primary ventilation exhaust fans which maintain a vacuum on the contaminated operating cells. It also houses two Standby Diesel Generators used to power critical loads in the event of a loss of normal electrical power.

Stack – The primary ventilation exhaust is discharged via the large Stack.

Low Point Pump Pit – Waste feed is delivered from H-Tank Farm via underground transfer lines. The transfer lines go to an intermediate pumping station in the Low Point Pump Pit and then on to receipt vessels in the Vitrification Building.

766-H – The building to the west is 766-H, the site training building that also houses some office space.

H-Canyon & H-Tank Farm – To the southwest you can see H-Canyon where nuclear material processing is performed. The H-Tank Farm facility is on the other side of H-Canyon.

Glass Waste Storage Building #1

There are two Glass Waste Storage Buildings, with this being the original. The loaded out Shielded Canister Transporter drives onto the operating floor. It grapples and lifts the

floor plug, lowers the canister into its storage rack in the vault below, and then replaces the floor plug. Operating floor ventilation fans remove diesel fumes during Shielded Canister Transporter operation. Each hole represents one storage location. In addition to normal locations, this building contains 24 oversize storage locations as a contingency. None have been used, and none are included in the design of Building #2. The floor and plugs are five feet thick. Building #2 does not include the office space included in this building.

That concludes our tour of DWPF.